

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
1 April 2004 (01.04.2004)

PCT

(10) International Publication Number
WO 2004/027862 A3

(51) International Patent Classification: **H01L 23/15**,
23/14

(21) International Application Number:
PCT/GB2003/004129

(22) International Filing Date:
19 September 2003 (19.09.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
02256515.4 19 September 2002 (19.09.2002) EP

(71) Applicant (for all designated States except US): **OPTI-TUNE PUBLIC LIMITED COMPANY [GB/GB]**; St George's House, 61-65 Conduit Street, London W1R 9FD (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **KARKKAINEN, Ari** [FI/FI]; Kontiotie 7 #F 69, Fin-90530 Oulu (FI).

(74) Agent: **DUTTON, Erica**; Rosemount, Pednorvale Road, Chesham, Buckinghamshire HP5 2ST (GB).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

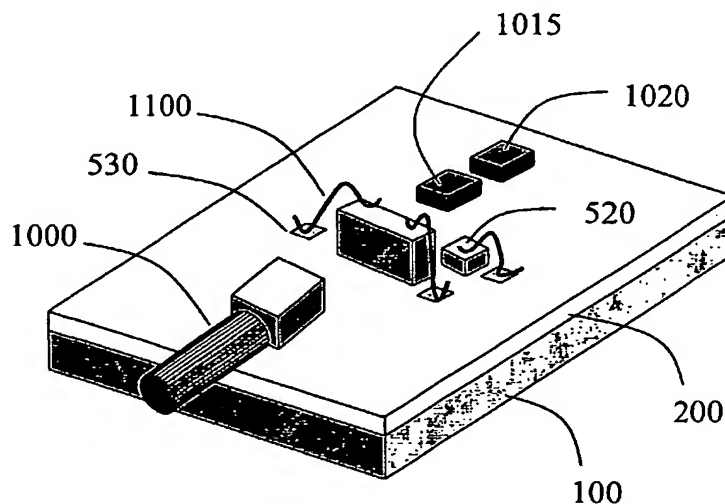
(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,

[Continued on next page]

(54) Title: **ELECTRONIC COMPONENT PACKAGING AND ASSEMBLY**



(57) Abstract: A packaging layer (200) for a wafer level assembly is fabricated from a glass material comprising both inorganic and organic components. This allows matching between the coefficient of thermal expansion of the packaging layer and that of other materials in the wafer assembly, particularly electrical interconnect materials. It is also possible to introduce properties to support such methods as photolithographic and low temperature processing of the packaging layer. This can improve fabrication accuracy and allows the packaging layer to be used with structures in a wafer assembly which might be damaged by high temperature processing, such as active optoelectronic devices and integrated circuits. Another major advantage is that the glass material can be used to provide optical characteristics as well as mechanical protection. The refractive index and other optical properties can be preselected and thus the glass material can be used for instance for waveguiding and index matching.

WO 2004/027862 A3



MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

Published:

— with international search report

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
3 June 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/JP 03/04129 28389

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H01L23/15 H01L23/14 Rec'd PTO 18 MAR 2005

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L H05K C03C G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 11, 30 September 1998 (1998-09-30) -& JP 10 150033 A (MATSUSHITA ELECTRIC IND CO LTD), 2 June 1998 (1998-06-02)	1,2,7, 16,24, 33,43, 44,46
Y	abstract	12-14, 21-23, 25, 38-42, 45,47
A		3-6, 8-11,15, 17-20, 26-32, 34-37, 51,52
	----- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

13 January 2004

Date of mailing of the international search report

02/04/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Krause, J

INTERNATIONAL SEARCH REPORT

Intern. Application No
PCT/JP 03/04129

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2001/014429 A1 (IHA MICHIAKI) 16 August 2001 (2001-08-16) paragraph [0018] - paragraph [0025] paragraph [0047] - paragraph [0062]	1,4,15, 24,46,47 2,3, 5-14, 16-23, 25, 31-33, 38,39, 42-45, 51,52
X A	US 4 696 851 A (PRYOR MICHAEL J) 29 September 1987 (1987-09-29) column 5, line 6 - column 6, line 42; figure 1	1,8-11, 17,46 2-7, 12-16, 18-25, 31-33, 38,39, 42-45, 47,51,52
Y A	US 5 478 778 A (TANISAWA YASUHIRO) 26 December 1995 (1995-12-26) cited in the application column 4, line 20 - column 5, line 67; figures 4,5A-C	12-14, 21-23, 25, 38-42, 45,47 33
A	US 6 177 728 B1 (SUSKO ROBIN A ET AL) 23 January 2001 (2001-01-23) the whole document	1,8-11, 46
A	US 6 144 795 A (DAWES STEVEN B ET AL) 7 November 2000 (2000-11-07) column 3, line 61 - column 15, line 44; figures 1,2	1-7,28, 46

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 03/04129

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-47, 51, 52

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB 03/04129

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-47, 51, 52

Substrate-based assembly suitable for carrying optical or electrical components and comprising a packaging layer, which comprises a hybrid glass material with organic and inorganic components, and method of fabrication.

2. claim: 48

Method of fabricating a substrate-based assembly comprising a mounted optical component, using lithographic processing of a packaging layer.

3. claim: 49

Method of fabricating a substrate-based assembly including bump bonding of an optical component.

4. claim: 50

Method of fabricating a substrate-based assembly including the forming of a tapered groove by gray scale lithography.

5. claim: 53

Method of fabricating a substrate-based assembly using a planarisation layer with apertures.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP 03/04129

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 10150033	A	02-06-1998	NONE	
US 2001014429	A1	16-08-2001	JP 3460657 B2 JP 2001210141 A GB 2358630 A ,B US 2003203317 A1	27-10-2003 03-08-2001 01-08-2001 30-10-2003
US 4696851	A	29-09-1987	CA 1253628 A1 CN 86102036 A ,B EP 0193907 A2 US 4712161 A	02-05-1989 19-11-1986 10-09-1986 08-12-1987
US 5478778	A	26-12-1995	JP 2762792 B2 JP 5060952 A US 5283446 A	04-06-1998 12-03-1993 01-02-1994
US 6177728	B1	23-01-2001	TW 424285 B US 6569711 B1	01-03-2001 27-05-2003
US 6144795	A	07-11-2000	US 6511615 B1 AU 5380298 A AU 723352 B2 CA 2274645 A1 CN 1245563 A EP 0960348 A1 JP 2001506372 T KR 2000057548 A KR 2000057567 A WO 9826315 A1 US 5991493 A	28-01-2003 03-07-1998 24-08-2000 18-06-1998 23-02-2000 01-12-1999 15-05-2001 25-09-2000 25-09-2000 18-06-1998 23-11-1999